Management	200	A.B.C.128/26
Core	300	A.B.C.64/26
Franchise	400	A.B.C.192/26
Subscribers	500	A.B.X.0/24 A.B.Y.0/24

Table 5. VLAN Network Addressing

Each node contains one (1) Uninterruptible Power Supply (UPS), the APC Smart-UPS 3000 RM 5U (Latin America and Asia)[10], that can provide emergency power to the failed node for five (5) to ten (10) minutes in the event of a power failure on the main source of power. This is enough time to properly power down the ensoBox™ and power it back up using a reserve generator. The UPS supports either a 230 V AC input circuit.

Core Node

The Core Node serves several functions including access to and from the Internet, routing between components, and routing between VLANs. A Cisco 2621 router provides a direct connection to the Internet and supports six (6) network connections:

1 – 10/100 Mbps auto-sensing Fast Ethernet connection to the Services Network
1 – 10/100 Mbps auto-sensing Fast Ethernet connection to the Core Network
1 – 10 Mbps Ethernet connection to the Management Network
1 – 10 Mbps Ethernet connection to the Franchise Network
2 – 10 Mbps Ethernet connections to the Subscribers Network

The Core Node is also responsible for data storage and data backup for the ensoBox™. A Network Attached Storage (NAS) device provides primary storage for subscribers' data, component software images, etc. A tape backup device performs daily, weekly, and monthly backups of all ensoBox™ data including email messages, web hosting files, subscriber files, services and software images. The tape jukebox can store up to 560 GB of data (compressed) or 280 GB of data (native). This solution provides for a quick recovery of lost data and/or services in the event of a failure to the ensoBox™.

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[10] The APC Smart-UPS 3000 RM 3U T is used in the United States.

Access Node

The Access Node supports dial connectivity to the ensoBox™. Subscribers can access ensoServices™ and the Internet by dialing into modems installed in the Access Node. Two (2) Cisco AS5300 Remote Access Servers (RAS) support all dial-up sessions. Each AS5300 can be configured with up to eight (8) T1s or eight (8) E1s, for a total of sixteen (16) per ensoBox™. Each T1 can support up to twenty-four (24) simultaneous remote dial sessions, and each E1 can support up to thirty (30) simultaneous remote dial sessions. A fully configured ensoBox™ (16 T1s or E1s) can support up to 384 simultaneous dial sessions (for T1 connectivity) or up to 480 simultaneous dial sessions (for E1 connectivity). The ensoBox™ can alternatively be configured with 240, 360, or 480 analog circuits.

A Cisco CE-505 Cache Engine is used to cache the most requested Internet data by subscribers. This does two things: it reduces network delay by storing more content locally, and it improves end user response time. The CE-505 and Cisco 2621 run WCCP version 2.0.

Services Node

The Services Node consists of six (6) application servers that support the web portal, email, chat, news, web hosting, and video conferencing (future service). Each service runs on six (6) application servers to ensure a high availability of services to subscribers. A Cisco CS-50 Content Smart Switch balances subscriber sessions amongst the application servers based on server load and server availability.

Server Stickiness

It is critical for subscribers to communicate with one mail server once an email session is established. To accomplish this, the CS-50 is configured with a "sticky" parameter that maintains a connection between the subscriber and a single mail server based on the Session ID (SID) established at the start of the mail session. In the event of a mail server failure, the session is permanently lost and the subscriber is redirected to an operational mail server at the time the service is requested again. However, the subscriber has to initiate a new mail session with the new mail server.

Spares Kit

Each ensoBox™ is shipped with a spares kit that includes:

    1 – Cisco 2621 router
    1 – Cisco Catalyst 2924 Fast Ethernet switch

1 – Cisco CS-50 Content Smart Switch

1 – Tatung workstation

1 – DLT7 Tape Jukebox

1 – Black Box Console Server

5   1 – APC UPS

Network Design

The functional goal of the ensoBox™ is to provide services and Internet access to ISP Franchise

10   subscribers, while also providing the back office management software required to run an ISP business. The design takes into account the need to add new features and functionality, add new services, and be able to support a growing subscriber base. The following description describes how the ensoBox™ is designed to meet optimal performance requirements and scale to meet technology changes and subscriber demands for new services.

15   The ensoBox™ connects directly to the Internet via a direct T1 or E1 Internet connection from an ISP. If a direct Internet connection is not available, then the ensoBox™ connects to the Internet via a satellite connection. The Internet connection is supported via a Serial WAN port on the Core Node Router (Cisco 2621 router). The Core Node Router then connects to the ensoBox™ VLANs through six (6)

20   network router ports, two (2) of which are 10/100 Mbps auto-sensing Fast Ethernet ports and four (4) of which are 10 Mbps Ethernet ports.

Figure 5 depicts the network design of the ensoBox™.

25   *Core Node*

The Core Node Router is connected to six (6) 10/100 Mbps auto-sensing ports on the Core Node Switch (Cisco Catalyst 2924 Fast Ethernet switch). These six (6) connections support five (5) VLANs, including the Core, Services, Management, Franchise, and Subscribers VLANs. The Subscribers

30   VLAN is supported through two (2) network connections from the router, while the other four (4) VLANs are supported by one (1) network connection each from the router.

The Core Node supports RADIUS, LDAP, and DNS using two (2) Tatung Model U10/440 Sun Ultra 10 Compatible SPARC Workstations. A third server supports the data backup software for the tape

35   jukebox (Benchmark DLT7 autoloader). RADIUS, LDAP, and DNS run on two (2) servers to ensure ensoBox™ operability in the event of a failure to one of the servers.